CRITERION 720

FIRE ALARM SYSTEMS

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RECORD OF REVISIONS

Revision No.	Date	Description
0	08/27/98	Initial Issue
1	05/17/02	This revision reflects the conversion from a WordPerfect document into a Microsoft Word document and additional clarification on how to develop criteria. This revision includes: • The addition of a Table of Contents, • The use of basis statements in Sections 6, 7 and 9. • Revision to Section 9, "Required Documents," and further clarification in the use of references. Changes to Section 4.0 to address O& M Criterion written by groups other than FWO-SEM.
	7/12/02	Changes to Section 4.4 per Writer's Guide change
	7/29/02	Incorporation of wording changes from FM Council in Sections 6.0 and 9.0

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CRITERION 720

FIRE ALARM SYSTEMS

1.0 PURPOSE

The purpose of this Criterion is to establish the minimum requirements and best practices for operation and maintenance of fire alarm systems at LANL.

This document addresses the requirements of LIR 230-05-01(Ref 10.1), "Operations and Maintenance Manual."

Implementation of this Criterion satisfies DOE Order 430.1A (Ref 10.2) for the subject equipment / system. DOE Order 430.1A (Ref 10.2)"Life Cycle Asset Management," Attachment 2 "Contractor Requirements Document," Paragraph 2, Sections A through C, which in part requires UC to "…maintain physical assets in a condition suitable for their intended purpose," and employ "preventive, predictive, and corrective maintenance to ensure physical asset availability for planned use and/or proper disposition." Compliance with DOE Order 430.1A is required by Appendix G of the UC Contract.

2.0 SCOPE

The scope of this Criterion includes the routine inspection, testing and preventive and predictive maintenance of fire alarm systems. This Criterion does not address corrective maintenance actions required to repair or replace equipment.

3.0 ACRONYMS AND DEFINITIONS

3.1 Acronyms

CAS	Central Alarm Station
DOE	Department of Energy
ITM	Inspection, Testing, and Maintenance
LIR	Laboratory Implementing Requirement
LPR	Laboratory Performance Requirement
O&M	Operations and Maintenance
PP&PE	Personal Property and Programmatic Equipment

RP&IE	Real Property and Installed Equipment
SSC	Structures, Systems, and Components
SSS	Support Services Subcontractor
UC	University of California

3.2 Definitions

Management Level Determination (ML1, ML2, ML3, ML4)-A classification system for determining the degree of management control applied to facility work. See LIR 230-01-02 for definitions of each ML level.

4.0 RESPONSIBILITIES

4.1 FWO-Systems, Engineering and Maintenance (SEM)

4.1.1 FWO-SEM is responsible for the administrative content of this Criterion and monitoring the applicability and the implementation status of this Criteria and either assisting the organizations that are not applying or meeting the implementation expectations contained herein or elevating their concerns to the director(s).

Basis: LIR 301-00-01.11 ; Issuing and Managing Laboratory Operations Implementation Requirements and Guidance, Section 5.4, OIC Implementation Requirements.

4.1.2 FWO-SEM shall provide technical assistance to support implementation of this Criterion.

4.2 FWO-Fire Protection (FWO-FIRE)

4.2.1 FWO-FIRE is responsible for the technical content of this Criterion and assessing the proper implementation across the Laboratory.

4.2.2 FWO-FIRE shall provide technical assistance to support implementation of this Criterion.

4.3 Facility Manager

4.3.1 Responsible for operations and maintenance of institutional, or Real Property and Installed Equipment (RP&IE) under their jurisdiction, in accordance with the requirements of this document.

4.3.2 Responsible for operations and maintenance of those Personal Property and Programmatic Equipment (PP&PE) systems and equipment addressed by this document that may be assigned to the FM in accordance with the FMU-specific Facility/Tenant Agreement.

4.3.3 Responsible for system performance analysis and subsequent replacement or refurbishment of assigned RP&IE and PP&PE.

4.4 Group Leader

4.4.1 Responsible for operations and maintenance of those Personal Property and Programmatic Equipment (PP&PE) systems and equipment addressed by this document, which are under their jurisdiction.

4.4.2 Responsible for system performance and subsequent replacement or refurbishment of assigned PP&PE

4.5 Support Services Subcontractor

4.5.1 Responsible for providing ITM of the fire protection systems addressed in this Criterion at the request of the responsible Facility Manager.

4.6 Authority Having Jurisdiction (AHJ) – Fire Marshal

4.6.1 The AHJ is responsible for providing a decision on a specific technical question regarding this Criterion.

5.0 PRECAUTIONS AND LIMITATIONS

5.1 Precautions

This section is not intended to identify all applicable precautions necessary for implementation of this Criterion. A compilation of all applicable precautions shall be contained in the implementing procedure(s) or work control authorization documents. The following precautions are intended only to assist the author of a procedure or work control document in the identification of hazards/precautions that may not be immediately obvious.

5.2 Limitations

The intent of this Criterion is to identify the minimum generic requirements and recommendations for SSC operation and maintenance across the Laboratory. Each user is responsible for the identification and implementation of additional facility specific requirements and recommendations based on their authorization basis and

unique equipment and conditions, (e.g., equipment history, manufacturer warranties, operating environment, vendor O&M requirements and guidance, etc.).

Nuclear facilities and moderate to high hazard non-nuclear facilities will typically have additional facility-specific requirements beyond those presented in this Criterion. Nuclear facilities shall implement the requirements of DOE Order 4330.4B (Ref. 10.3) as the minimum programmatic requirements for a maintenance program. Additional requirements and recommendations for SSC operation and maintenance may be necessary to fully comply with the current DOE Order identified above.

6.0 REQUIREMENTS

Minimum requirements that Criterion users shall follow are specified in this section. Requested variances to these requirements shall be prepared and submitted to FWO-SEM in accordance with LIR 301-00-02 (Ref. 17980.4), "Variances and Exceptions to Laboratory Operations Requirements," for review and approval. The Criterion users are responsible for analysis of operational performance and SSC replacement or refurbishment based on this analysis. Laws, codes, contractual requirements, engineering judgement, safety matters, and operations and maintenance experience drive the requirements contained in this section.

6.1 Operations Requirements

6.1.1 Operations Checklist

The fire alarm system must remain in service at all times. The fire alarm system shall be deemed operational when the following conditions are met (including automatic transmission of signals to CAS):

- Alternating current (AC) is supplied to the system (normal power).
- Direct current (DC) is supplied to the system (emergency/backup power).
- All required alarm initiation devices are installed and operational.
- All required alarm notification appliances are installed and operational.
- The control panel is clear of any faults, alarms, supervisory signals, and trouble conditions.
- Sprinkler waterflow alarms are operational.
- Supervisory devices are operational.

Basis: NFPA 72, 1999 Edition National Fire Alarm Code, Chapter 7 and NFPA 25, 1998 Edition Inspection, Testing, and Maintenance of Water Based Fire Protection Systems, Chapter 2.

6.2 Maintenance Requirements

6.2.1 The SSS performing ITM shall coordinate with the operating group, and Facility Manager to conduct ITM in the affected area.

6.2.2 Testing (including transmission of alarm)

6.2.2.1 Fire alarm system testing shall be conducted in accordance with Appendix B to this Criterion (equivalent to NFPA 72, Table 7-3.2, except that Heat Detectors, Smoke Detectors, and Manual Pull Stations (alarm only) shall be tested every 2 years).

Basis: Two-year testing frequencies are established by a DOE approved equivalency to the test frequencies established by NFPA 25, 1998 Edition for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems, and NFPA 72, 1999 Edition, National Fire Alarm Code. The equivalency is an approval for all facilities excluding designated nuclear facilities.

6.2.2.2 Fire alarm systems and other systems and equipment that are associated with fire alarm systems and accessory equipment shall be tested using methods described in NFPA 72, Table 7-2.2.

Basis: NFPA 72, 1999 Edition, National Fire Alarm Code.

6.2.2.3 Testing of audible or visual notification appliances shall verify the alarm can be heard and/or seen from all areas. During this testing, consideration should be given to the normal ambient noise in the area (ex., fans, motors, etc.).

Basis: NFPA 72, 1999 Edition, National Fire Alarm Code.

6.2.3 Inspection

Visually inspect fire alarm system components as described in NFPA 72 Table 7-3.1. Appendix A of this Criterion lists the equipment required to be visually inspected (refer to NFPA 72 Table 7-3.1 for inspection frequencies).

6.2.4 Maintenance

6.2.4.1 Smoke Detectors

- Using one of the methods described in NFPA 72 Table 7-2.2, Test Methods, check the sensitivity of each smoke detector within 1 year of installation and every 2 years thereafter in accordance with the manufacturer's instructions. Use manufacturer approved equipment to conduct test. Clean any smoke detector found to be outside its listed and marked sensitivity range (or 4% obscuration light gray smoke, if not marked) per manufacturer's recommendations and

recheck for correct sensitivity before reinstalling the unit.

- See NFPA 72-7-2.2, Test Methods, for additional information.

Basis: NFPA 72, 1999 Edition National Fire Alarm Code and NFPA 25, 1998 Edition for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems.

6.2.4.2 Repair or replace any device that fails a test or inspection in accordance with the manufacturer's instructions.

Basis: NFPA 72, 1999 Edition, National Fire Alarm Code and NFPA 25, 1999 Edition for the Inspection, Testing, and Maintenance of Water Based Fire Protections Systems.

6.3 Impairments and Modifications

If one or more of the operational requirements listed in Section 6.1 above are not met, follow the requirements in Criterion 733, Fire Protection System Impairment Control Program.

6.3.1 Inspection (following an Impairment or Modification)

Visually inspect the system before returning it to service (see Appendix A).

6.3.2 Testing (following an Impairment or Modification)

Test the device(s) affected to verify they are operating properly (included transmission of alarms to CAS).

Basis: All requirements regarding impairments are based upon NFPA 72, 1999 Edition National Fire Alarm Code and NFPA 25, 1998 Edition Inspection, Testing, and Maintenance of Water Based Fire Protection Systems, Section 11-7.

7.0 RECOMMENDATIONS AND GOOD PRACTICES

The information provided in this section is recommended based on acceptable industry practices and should be implemented by each user based on his/her unique application and operating history of the subject systems/equipment.

7.1 Operations Recommendations

7.1.1 Operational testing and alarm verification will be conducted by SSS personnel, in compliance with LIR 402-910-01, Section 6.0.

Basis: LIR 402-910-01, LANL Fire Protection Program

7.2 Maintenance Recommendations

7.2.1 As a core function, the SSS provides inspection, testing, and maintenance services for complex fire protection systems and shall remove systems from service for testing, drills, modifications, repairs and related activities.

Basis: LIR 402-910-01, LANL Fire Protection Program

8.0 GUIDANCE

8.1 Operations Guidance

8.1.1 Not applicable

8.2 Maintenance Guidance

8.2.1 Not applicable

9.0 REQUIRED DOCUMENTATION

Maintenance history shall be maintained by the FM for fire alarm systems to include, as a minimum, the parameters listed in the Table 9-1 below:

Table 9-1 Documentation Parameters

MAINTENANCE HISTORY DOCUMENTATION PARAMETERS				
PARAMETER	**ML 1**	**ML 2**	**ML 3**	**ML 4**
Fire Alarm Maintenance Activities				
Repair / Adjustments	**X**	**X**	**X**	**X**
PM Activities	**X**	**X**	**X**	**X**
Fire Alarm Equipment Problems				
Failure Dates	**X**	**X**	**X**	**X**
Failure Root Cause	**X**	**X**	**X**	**X**
Fire Alarm Inspection Results (per this Criterion)				
Inspection Date	**X**	**X**	**X**	**X**
SSC Condition	**X**	**X**	**X**	**X**

Basis: Documentation of the parameters listed in Table 9-1 above satisfies the requirements of LPR 230-07-00, Criteria 2, (Ref. 10.5) which states; "Maintenance activities, equipment problems, and inspection and test results are documented."

10.0 REFERENCES

The following references, and associated revisions, were used in the development of this document.

10.1 DOE O 430.1A, Attachment 2 "Contractor Requirements Document" (Paragraph 2, Sections A through C), a requirement of Appendix G of the UC Contract.

10.2 DOE Order 4330.4B, Maintenance Management Program, Section 3.4.9.

10.3 LIR 230-05-01.0, Operations and Maintenance Manual.

10.4 LIR 230-01-02.2, Graded Approach for Facility Work.

10.5 LIR 301-00-02.0, Variances and Exceptions to Laboratory Operation Requirements.

10.6 LIR 402-910-01.4, LANL Fire Protection Program

10.7 LPR 230-07-00, Maintenance History, Performance Criteria [2].

10.8 NFPA 25, 1998 Edition Inspection, Testing, and Maintenance of Water Based Fire Protection Systems.

10.9 NFPA 72, National Fire Alarm Code, 1999 Edition

10.10 US DOE-AL Memorandum, *Equivalency for Testing Frequencies of Initiating Devices in NFPA 72, National Fire Alarm Code*, April 8, 1999; LANL Memorandum FSS-21-98-009, *Proposed Equivalency to NFPA Standard 72*, March 27, 1998.

10.11 US DOE-AL/LAAO Memorandum, *Transmittal Letter for NFPA 25 Equivalency Requests*, January 26, 2000; LANL Memorandum FE-21-98-005, *Proposed Equivalency to NFPA Standard 25*, June 9, 1998.

11.0 APPENDICES

11.1 Appendix A – Visual Inspection List

11.2 Appendix B – Testing Frequencies

APPENDIX A

VISUAL INSPECTION LIST

Requirement: Visually inspect to ensure that there are no changes that can affect equipment operations. (Ref. NFPA 72 Table 7-3.1)

1. Inspect Fire Alarm Systems monitored for alarm, supervisory, trouble signals:
   - Fuses
   - Interfaced Equipment
   - Lamps and LEDs
   - Primary (Main) Power Supply
2. Inspect Fire Alarm Systems unmonitored for alarm, supervisory, trouble signals:
   - Fuses
   - Interfaced Equipment
   - Lamps and LEDs
   - Primary (Main) Power Supply
3. Inspect batteries for leakage, discoloration of wiring, terminal corrosion, and damage to the battery enclosure.
4. Inspect control panels for trouble signals.
5. Inspect Fiber-optic Cable Connections.
6. Inspect Emergency Voice/Alarm Communications Equipment.
7. Inspect Remote Annunciators.
8. Inspect initiating devices for damage and tampering.
   - Air sampling devices
   - Duct detectors
   - Electromechanical Releasing Devices
   - Fire Suppression System Switches
   - Fire Alarm Boxes
   - Heat Detectors
   - Radiant Energy Fire Detectors
   - Smoke Detectors
   - Supervisory Signal Devices
   - Waterflow Devices
9. Check occupant notification devices (bells, horns, strobes, etc.) for tampering or damage to the enclosure.
10. Inspect Guard's Tour equipment.
11. Inspect Interface Equipment.
12. Inspect Alarm Notification Appliances, including Notification Booster Power Supply Panels.
13. Inspect Supervising Station Fire Alarm Systems – Transmitters:
    - DACT (Digital Alarm Communicator Transmitter)

- DART (Digital Alarm Radio Transmitter – not currently used at LANL)
- RAT (Radio Alarm Transmitter – not currently used at LANL)

14. Inspect Supervising Station Fire Alarm Systems – Receivers:
    - DACR ((Digital Alarm Communicator Receiver)
    - DARR (Digital Alarm Radio Receiver – not currently used at LANL)
    - Two-way RF Multi-plex (not currently used at LANL)
    - RASSR (Radio Alarm Supervising Station Receiver – not currently used at LANL)
    - RARSR (Radio Alarm Repeater Station Receiver – not currently used at LANL)
    - Private Microwave (not currently used at LANL)

APPENDIX B

TESTING FREQUENCIES

(Based on NFPA 72, Table 7-3.2)

Testing Frequencies

Component	Initial Reacceptance	Monthly	Quarterly	Semi-Annually	Annually	Other
1. Control Equipment – Building Systems Connected to Supervising Station						
a. Functions	X	--	--	--	X	--
b. Fuses	X	--	--	--	X	--
c. Interfaced Equipment	X	--	--	--	X	--
d. Lamps and LEDs	X	--	--	--	X	--
e. Primary (Main) Power Supply	X	--	--	--	X	--
f. Transponders	X	--	--	--	X	--
2. Control Equipment – Building Systems – Not Connected to a Supervising Station	--	--	--	--	--	--
a. Functions	X	--	X	--	--	--
b. Fuses	X	--	X	--	--	--
c. Interfaced Equipment	X	--	X	--	--	--
d. Lamps and LEDs	X	--	X	--	--	--
e. Primary (Main) Power Supply	X	--	X	--	--	--
f. Transponders	X	--	X	--	--	--
3. Engine-Driven Generator – Central Station Facilities and Fire Alarm Systems	X	X	--	--	--	--
4. Engine-Driven Generator – Public Fire Alarm Reporting Systems	X	--	--	--	--	--
5. Batteries – Central Station Facilities						
a. Lead-Acid Type	--	--	--	--	--	--
1. Charger Test (Replace battery as needed)	X	--	--	--	X	--
2. Discharge Test (30 minutes)	X	X	--	--	--	--
3. Load Voltage Test	X	X	--	--	--	--
4. Specific Gravity	X	--	--	X	--	--
b. Nickel-Cadmium Type	--	--	--	--	--	--
1. Charger Test (Replace battery as needed)	X	--	X	--	--	--
2. Discharge Test (30 minutes)	X	--	--	--	X	--
3. Load Voltage Test	X	--	--	--	X	--
c. Sealed Lead-Acid Test	X	X	--	--	--	--
1. Charger Test (Replace battery as needed)	--	X	X	--	--	--
2. Discharge Test (30 minutes)	X	X	--	--	--	--
3. Load Voltage Test	X	X	--	--	--	--

APPENDIX B

TESTING FREQUENCIES

(Based on NFPA 72, Table 7-3.2)

Testing Frequencies (continued)

Component	Initial Reacceptance	Monthly	Quarterly	Semi-Annually	Annually	Other
6. Batteries – Fire Alarm Systems						
a. Lead-Acid Type	--	--	--	--	--	--
1. Charger Test (Replace battery as needed)	X	--	--	--	X	--
2. Discharge Test (30 Minutes)	X	--	--	X	--	--
3. Load Voltage Test	X	--	--	X	--	--
4. Specific Gravity	X	--	--	X	--	--
b. Nickel-Cadmium Type	--	--	--	--	--	--
1. Charger Test (Replace battery as needed)	X	--	--	--	X	--
2. Discharge Test (30 minutes)	X	--	--	--	X	--
3. Load Voltage Test	X	--	--	X	--	--
c. Primary Type (Dry Cell)	--	--	--	--	--	--
1. Load Voltage Test	X	X	--	--	--	--
d. Sealed Lead-Acid Type	--	--	--	--	--	--
1. Charger Test (Replace battery as needed)	X	--	--	--	X	--
2. Discharge Test (30 minutes)	X	--	--	--	X	--
3. Load Voltage Test	X	--	--	X	--	--
7. Batteries – Public Fire Alarm Reporting Systems	X (daily)	--	--	--	--	--
Voltage tests in accordance with NFPA 72, Table 7-2.2, 7(a)-(f)						
a. Lead-Acid Type	--	--	--	--	--	--
1. Charger Test (Replace battery as needed)	X	--	--	--	X	--
2. Discharge Test (2 hours)	X	--	X	--	--	--
3. Load Voltage Test	X	--	X	--	--	--
4. Specific Gravity	X	--	--	X	--	--
b. Nickel-Cadmium Type	--	--	--	--	--	--
1. Charger Test (Replace battery as needed)	X	--	--	--	X	--
2. Discharge Test (2 hours)	X	--	--	--	X	--
3. Load Voltage Test	X	--	X	--	--	--
c. Sealed Lead-Acid Type	--	--	--	--	--	--
1. Charger Test (Replace battery as needed)	X	--	--	--	X	--
2. Discharge Test (2 hours)	X	--	--	--	X	--
3. Load Voltage Test	X	--	X	--	--	--
8. Fiber-Optic Cable Power	X	--	--	--	X	--
9. Control Unit Trouble Signals	X	--	--	--	X	--
10. Conductors – Metallic	X	--	--	--	--	--
11. Conductors – Nonmetallic	X	--	--	--	--	--
13. Retransmission Equipment (NFPA 72, Section 7-3.4 shall apply)	X	--	--	--	--	--
14. Remote Annunciators	X	--	--	--	X	--

APPENDIX B

TESTING FREQUENCIES

(Based on NFPA 72, Table 7-3.2)

Testing Frequencies (continued)

Component	Initial Reacceptance	Monthly	Quarterly	Semi-Annually	Annually	Other
15. Initiating Devices	--	--	--	--	--	--
a. Duct Detectors	X	--	--	--	X	--
b. Electromechanical Releasing Device	X	--	--	--	X	--
c. Fire-Extinguishing System(s) or Suppression System(s) Switches	X	--	--	--	X	--
d. Fire-Gas and Other Detectors	X	--	--	--	X	--
e. Heat Detectors (See NFPA 72, Section 7-3.2.3)	X	--	--	--	--	2yr.
f. Fire Alarm Boxes	X	--	--	--	--	2yr.
g. Radiant Energy Fire Detectors	X	--	--	X	--	--
h. All Smoke Detectors – Functional	X	--	--	--	--	2yr.
i. Smoke Detectors – Sensitivity (See NFPA 72, Section 7-3.2.1)	--	--	--	--	--	--
j. Supervisory Signal Devices	X	--	X	--	--	--
k. Waterflow Devices (except valve tamper switches.)	X	--	--	X	--	--
l. Valve Tamper Switches	X	--	--	X	--	--
16. Guard's Tour Equipment	X	--	--	--	X	--
17. Interface Equipment (HVAC, doors, etc.)	X	--	--	--	X	--
18. Special Hazard Equipment	X	--	--	--	X	--
19. Alarm Notification Appliances	X	--	--	--	X	--
a. Audible Devices	X	--	--	--	X	--
b. Audible Textual Notification Appliances	X	--	--	--	X	--
c. Visible Devices	X	--	--	--	X	--
d. Notification Booster Power Supply Panels	X	--	--	--	X	--
20. Off-Premises Transmission Equipment	X	--	X	--	--	--
21. Supervising Station Fire Alarm Systems – Transmitters	--	--	--	--	--	--
a. DACT	X	--	--	--	X	--
b. DART	X	--	--	--	X	--
c. McCulloh	X	--	--	--	X	--
d. RAT	X	--	--	--	X	--
22. Special Procedures	X	--	--	--	X	--
23. Supervising Station Fire Alarm System–Receivers	--	--	--	--	--	--
a. DACR	X	X	--	--	--	--
b. DARR	X	X	--	--	--	--
c. McCulloh Systems	X	X	--	--	--	--
d. Two-Way RF Multiplex	X	X	--	--	--	--
e. RASSR	X	X	--	--	--	--
f. RARSR	X	X	--	--	--	--
g. Private Microwave	X	X	--	--	--	--